geology. *Priz Trémont*—To the savant, artist, or mechanic requiring assistance to attain an object of use or benefit to France. *Priz Gegner*—For the assistance of the savant distinguished for his contributions to the positive sciences. *Priz Delalande-Guérineau*—To the young French explorer, or the man of science, who shall have rendered the greatest service to France or science. *Priz Jerome Ponti*—To the author of scientific work of which the continuation or development is important to science. *Priz Tchihatchen*—To the naturalist of any nationality who shall have pursued explorations in the Asiatic continent or neighbouring islands, having for their object the advancement of any branch of natural, physical, or mathematical science. *Priz Houllevigue*—Awarded in rotation by the Academy of Sciences, and by the Academy of Fine Arts. *Priz Cahours*—For the encouragement of young workers known for their interesting researches, and more especially for researches in chemistry. *Priz Alberto-Lévy*—For a means of preventing or curing diphtheria. *Priz Laplace*—To the head student of the École Polytechnique.

1895. For the improvement of the theory of the relation between the flywheel and the regulator. *Priz Gay*—For a study of the régime of rain and snow over the whole surface of the earth. *Priz L. La Caze*—To the authors of the best work on physics, chemistry, and physiology. *Priz Delesse*—To the author of a work dealing with geology or mineralogy. *Priz Bordin*—For the memoir that adds most to the knowledge of natural history (zoology, botany, or geology) of Tonkin or one of the French possessions in Central Africa. *Grand Priz des Sciences Physiques*—For the work that contributes most to the advancement of French palæontology by dealing in a thorough manner with the vertebrata of the coal measures, and those of the secondary epoch, and comparing them with existing types. *Priz Chaussier*—For important works in legal or in practical medicine. *Priz Petit d'Ormoy*—Pure and applied mathematics or natural science. *Priz Leconte*—To be awarded (1) to the authors of new and important discoveries in mathematics, physics, chemistry, natural history, or medical sciences; (2) to the authors of new applications in these sciences. *Priz Gaston Planté*—To the French author of a discovery, invention, or important work in the domain of electricity.

1896. *Priz Janssen*—Astronomical physics. *Priz Serres*—On general embryology, applied as far as possible to physiology and medicine. *Priz Jean Renaud*—For the best work published during the preceding five years.

1898. *Priz Damoiseau*—For a development of the theory of the perturbations of Hyperion, the satellite of Saturn discovered simultaneously by Bond and Lassell in 1848, principally taking into account the action of Titan. Also to compare observation with theory, and thence deduce the mass of Titan.

SCIENCE IN THE MAGAZINES.

PROF. J. W. JUDD contributes to the *Fortnightly* an article on "The Chemical Action of Marine Organisms," dealing with the nature of the ocean-floor, and showing that the operations going on there are similar to those described by Darwin in his work on vegetable mould and earthworms. Prof. Judd favours the organic view of the origin of manganese nodules, and believes that the chemical theory is improbable. He says:—

"All the facts collected by the deep-sea exploring expeditions point to the conclusion that accumulation of material is going on with the most extreme slowness at these abysmal depths where the manganese nodules are found in greatest abundance, and it may well be that these slowly accumulating muds have been passed through the bodies of marine worms or other organisms an almost infinite number of times. At each passage of the clay through the organism a small addition of manganese and iron oxides would be made to the mass by the action of the living structure on the sea water, and thus in the course of time these oxides might be sufficiently concentrated to build up, by concretionary action, the remarkable nodules on the ocean-bed.

"Such action would be in complete analogy with processes going on both in fresh and salt water, by which calcareous, silicious, phosphatic, and ferruginous deposits are being everywhere formed in the waters of the ocean, while all theories of the direct separation of the manganese and rarer metals from their state of excessively dilute solution in sea-water by chemical reactions appear to me to be beset with the greatest difficulty. All the observations that have been made in recent years upon the deposits of the ocean-floor point to one conclusion, namely, that where materials have once passed into a state of solution in the waters of the sea they can only be separated from it in the open ocean by the wonderful action of living organisms."

Prof. Buechner discusses "The Origin of Mankind," his article being more or less a review of a pamphlet by Abel Hovelacque, entitled "Les débuts de l'humanité," in which the results derived from archæological researches are compared with the observations of travellers as to the lowest types of the human family that can exist. Captain Gambier, R.N., writes on "The True Discovery of America." He shows that Jean Cousin, a sea-captain of Dieppe, discovered the River Amazon in 1488, that is, four years before Columbus discovered San Salvador. There is clear evidence that Cousin was thoroughly conversant with all that was known of geography, hydrography, and nautical astronomy in his day, and that he sailed up the Maragnon, which was his name for the River Amazon as he heard it from the natives. On board Cousin's ship, as second in command, was a man named Vincent Pinçon, and Captain Gambier's contention is that this Pinçon was the same man as the Vincent Pinçon who is known to have commanded one of the ships under Columbus. The Pinçon that sailed with Cousin was tried by court-martial for insubordination when the ship returned to Dieppe, and was condemned to perpetual banishment from the soil of France. He went to Genoa, and from there to Palos, in Andalusia, where his two brothers carried on the business of shipowners and traders, making occasional voyages themselves. It is not too much to suppose that Columbus met the Pinçons, and was indebted to them for information about Cousin's voyage. Jealousy and human self-interest will explain why Cousin's name was carefully omitted from all writings referring to the discovery that was afterwards made by Columbus and the three Pinçons who accompanied him on the celebrated voyage.

In addition to these articles, the *Fortnightly* contains one in which Dr. Thin comments upon the most important points brought out in the Report of the Leprosy Commission in India.

The *New Review*, which appears for the first time this month as an illustrated review, contains an article on the late Prof. Tyndall, by Mr. P. Chalmers Mitchell. Sir William Flower contributes to *Good Words* an excellent description of the structure and action of "Birds' Wings." "The Vanishing Moose and their Extermination in the Adirondacks" is the title of a well-illustrated article by Mr. Madisson Grant in the *Century*. Mr. Grant says that the last moose in New York State was killed on the east inlet of Raquette Lake, in the autumn of 1861. In the *Century* also is related the circumstances that led to the first employment of chloroform, in 1847, by Sir James Simpson, the scribe being his daughter, Miss E. B. Simpson. Since chloroform may soon be superseded by some newer anæsthetic, it is well that the events which established it as the great alleviator of animal suffering have been recorded. Other magazines received by us are the *Humanitarian*, which reprints the address on "Biology and Ethics," recently delivered by Sir James Crichton Browne at Sheffield, *Scribner*, the *National Review*, *Contemporary*, the *Modern Review*, and *Longman's*, but none of these contain any articles of scientific interest.

THE RISE OF THE MAMMALIA IN NORTH AMERICA.

I.

IN a remarkable address delivered before the Zoological section of the American Association for the Advancement of Science, at the Madison meeting, in August, Prof. H. F. Osborn gave an account of the recent achievements of exploration and research in connection with the rise of the mammalia in North America, and suggested the lines along which further advances were desirable. The length of the address precludes its complete publication here, but the most important features will be found in the following extracts. Among the omitted portions are sections dealing with the origin and evolution of Trituberculism, the succession of the Perissodactyls, and that of the Artiodactyls, and the relation of the Ancylopoda (Cope) to the law of correlation.

Twenty years ago an era opened in the mammalian palæontology of Europe and America. Partly inspired by the *Odontographie* of Rütimeyer, Kowalevsky completed and published in 1873 his four remarkable memoirs upon the hoofed mammals. He wrote these four hundred and fifty quarto pages in three languages not his own, in French upon *Anchitherium* and the ancestry of the horses, in English upon the *Hyopotamidæ*, in German upon *Gelocus*, *Anthracotherium* and *Entelodon*, including the first attempt at an arrangement of a great group of mammals upon the basis of the descent theory. These memoirs swept aside all the dry traditional fossil lore of Europe; they breathed the new spirit of Darwin, to whom the chief one was dedicated, making principles of descent of more importance than new genera and species. Kowalevsky thus summed up the contemporary palæontology:

"After the splendid osteological investigations of Cuvier had revealed to science a glimpse of a new mammalian world of wonderful richness, his successors have been bent rather upon multiplying the diversity of this extinct creation, than on diligently studying the organisation of the fossil forms that successively turned up through the zeal of amateurs and collectors. . . . With the exception of England (referring to Owen, Huxley, Falconer, and others), where the study of fossil mammalia was founded on a sound basis, and some glorious exceptions on the Continent (referring to Rütimeyer, Gaudry, Fraas, Milne-Edwards), we have very few good palæontological memoirs in which the osteology of extinct mammals has been treated with sufficient detail and discrimination; and things have come to such a pass, that we know far better the osteology of South American, Australian, and Asiatic genera of fossil mammals than of those found in Europe."

At the same time, between 1871 and 1873, the pioneers of American palæontology, Leidy, Marsh, and Cope, began the exploration of our ancient lake basins rich in life. The first ten years of their work not only revolutionised our ideas of mammalian descent, but brought together the data for the generalisations of the second decade; for Marsh's demonstration of the laws of brain evolution in relation to survival; for Cope's proof of ungulate derivation from types with the simple foot resting upon the sole, and with the ancestral conic or bunodont molar tooth; and finally for Cope's demonstration of the tritubercular molar as the central type in all the mammalia. These four generalisations furnished a new working basis for morphology and phylogeny.

In these twenty years, thanks to energetic field work, we have accumulated vast materials for the history of the rise of the mammalia, enough for ten students where there is one, and the questions arise: How shall we take best advantage of it? What methods shall we adopt? In this address, besides bringing before you the more recent achievements of exploration and research, I will try to illustrate the advances already made in lines of thought, observation and system in palæontology, and indicate other advances which seem to me still desirable. In the problem of how to think and work most effectively, and with most permanent results, all the sciences meet on common ground.

It is to the renown of the veteran Rütimeyer and of Kowalevsky, whose death we have to deplore, that, while their main inductions suffer by American discoveries, their methods of thought have not been displaced. It matters little that their theory that ungulate molars sprang from lophodont or crested forms, has been disproved; that Kowalevsky's tables of descent are full of errors; that his main generalisation as to the persistence of adaptive and extinction of inadaptive foot types does not hold good; that the horses and Anchitherium spring not from Palæotherium as he supposed, but from *Pachynolophus* and *Hyracotherium*, types which he carefully studied and yet omitted from the horse line! It is the right system of thought which is most essential to progress; better in the end wrong results such as the above, reached by the right method, than right results reached haphazard by a vicious method. If a student asked me how to study palæontology, I could do no better than direct him to the *Versuch einer natürlichen Classification der fossilen Hufthiere*, out of date in its facts, thoroughly modern in its approach to ancient nature. This work is a model union of the detailed study of form and function with theory and the working hypothesis. It regards the fossil not as a petrified skeleton, but as moving and feeding; every joint and facet has a meaning, each cusp a certain significance. Rising to the philosophy of the matter, it brings the mechanical perfection and adaptiveness of different types into relation with environment, the change of herbage, the introduction of grasses. In this connection it speculates upon the causes of the rise, spread and extinction of each animal group. In other words the fossil quadrupeds are treated *biologically*—so far as is possible in the obscurity of the past. From such models and from our own experience we learn to abandon such traditions in the use of the tools of science as mere methods of description and classification, and to regard priority only in the matter of nomenclature.

To illustrate some of these modern methods, let us first look at the evolution of the teeth in the rise of the mammalia. The teeth and the feet are the foci of mammalian evolution, the only direct points of contact with food and the earth. Their combined use in phylogeny has increased in interest, because their evolution has proved to be wholly independent. We recall Cuvier's famous claim, of which Balzac said at the time: "Rebuilt like Cadmus, cities from a tooth."

No generalisation has been more thoroughly routed than that of a necessary law of correlation between tooth and foot structure. Besides the orthodox clawed carnivores and hoofed pachyderms of the great French anatomist, we have discovered hoofed carnivores such as Mesonyx, and clawed pachyderms such as Chalicotherium. Even the apparently lasting barriers of correlation, which Owen raised between the even and odd-toed ungulates, have broken down by Ameghino's discovery of a Litoptern odd-toed horse with an even-toed type of astragalus. Not only is there no correlation of type, but none in the rate of evolution. Hipparion, the most progressive horse in tooth-structure, probably owed its extinction to its conservative preservation of its ancestral three toes. For these reasons the teeth and feet, owing to the frequent parallels of adaptation, may wholly mislead us if taken alone; while, if considered together, they give us a sure key; for no case of exact parallelism in both teeth and feet between two unrelated types has yet been found, or is likely to be. This, I believe, is the one lesson of later work which reverts to older methods; we should not base either classification or descent upon the teeth or feet alone. Every additional character diminishes the chances of error.

Lower Mesozoic Pro-mammalia.

With the exception of the triassic *Theriodesmus* of Seeley, no mammal is known by its limbs or skeleton until we reach the basal Eocene; in studying the first steps in the rise of the mammalia, we are thus practically driven to the teeth and jaws alone. In these straits of the fossil-hunter, embryology has lately come to our aid.

Assuming their remote reptilian origin, agreeing with Baur and Kükenthal that the theriomorph reptiles were parallel with rather than ancestral to the mammals, and therefore placing before both groups the hypothetical *Sauro-mammals* in or below the Permian, we come to the old question which Huxley discussed in his famous anniversary address: "Was there a succession between Monotremes, Marsupials, and Placentals, or a parallel development from a common pro-mammalian type?" Then we look to the newer questions: "When were the Edentates and Cetaceans given off?"

Modern tooth science springs first from the recent demonstration of Rütimeyer's hypothesis of 1869, that the teeth of all the mammals centre around a single reptile-derived type. With a single exception, which I believe can be disposed of, various stages of trituberculism or a three-cusped condition have become the standard for the teeth, as pentadactyly has long been for the feet, except that this is developed within the mammalian stem, while our five fingers are a reptilian legacy. Second, it springs from the recent thorough exploration of the youngest jaws for evidences as to the primitive form and succession of the teeth. This also supports the reptile theory of tooth descent by proving, what has been in considerable doubt, that the Pro-mammalia had a multiple succession of teeth like the reptiles, and that even some of the modern mammals retain dim traces of four series of teeth.

The brilliant discoveries of Kükenthal, Leche, and Röse begin to show how in various ways the mammals early modified the regular succession of all the teeth by suppression of parts of the multiple series. This is the first thing to consider. The next is how heterodontism arose, how the rows of conic teeth were specialised in different parts of the jaw for three or four functions. As a certain number of teeth took up each function, the question arises whether their number or dental formula was ever the same in all the mammals, for we know it is very different now. After the teeth were thus divided, some functions became more important than others, and established a monopoly, causing first a marked difference in the relative development of the series, which we may express in a dental curve, resulting finally in a loss of certain teeth. In the meantime began the special evolution of the form of the back teeth, or molars. Was this alike in all mammals; was it tritubercular? It is surprising how many problems of early relationship are at stake in the discussion of these simple processes.

Primitive Diphyodontism.

What does *succession* really consist in? It now appears that Baume was right in denying that the first tooth is the mother of the second; for the teeth of the lower as well as the upper series spring from the common epithelial dental fold (Schmelzleiste) which dips down from the surface and extends the whole length of the jaw; at intervals it buds off the dental caps (Schmelzkeim) of the first series; after these are separated off, the dental fold sinks and buds off the dental caps of the second series, always below and inside the first; thus the fold is the mother and the caps are sisters, twins, or triplets, according to the number of the series. In all young mammals, including the traditional monophyodont Cetaceans and Edentates, and excepting only the still unexplored Monotreme embryos, traces of two series of teeth have been found. Both Leche and Röse have detected evidence that the dental fold sometimes buds off parts of a third series, thus explaining the occasional reversion of supernumerary teeth on the inner side of the second series, and Leche has seen traces of budding preceding the first series—thus giving us vestiges of four successions!

All our perplexities as to the relations of the milk and permanent teeth, and the ingenious but mistaken hypotheses of Baume, Flower, Wortman, and Cope have sprung from our want of evidence of the regular and complete diphyodontism of the stem mammals. The solution is in brief that the "milk teeth" and the "true molars" are descended from the first series, while the second series is represented by the "permanent incisors, canines, and pre-molars" and rudiments of dental caps beneath the true molars. The mammals early began to diverge from this primitive diphyodontism in many ways; apparently adapting the first and second series, respectively, to their infant and mature feeding habits; losing parts or all of one series or the other, and in some cases pushing teeth of the second series in among the first; this intercalation has been a most confusing factor to us.

In the Marsupials (Kükenthal) almost the entire first series became permanent; thus from the Jurassic period to the present time only a solitary fourth premolar of the second series has pushed out its elder-sister tooth, and Röse has observed that an outer upper-incisor also pushes up from the second series; the remainder of the second series still persist as rudimental dental caps beneath the first, even beneath the first and second molars! There are wide variations among the Placentals; thus in the lowest existing forms, the Insectivora, Leche finds that in the Shrew (*Sorex*) the second series is suppressed entirely, while in the Hedgehog (*Erinaceus*) of the twelve permanent teeth in the anterior part of the jaws five belong to the first series and seven to the second. We thus meet with the paradox, that among the "primitive" Marsupials and Insectivores the regular reptilian succession was early interrupted, while in all the "higher" mammals the reptilian succession of two series was retained in the anterior part of the jaw. Beneath the posterior highly-specialised molar teeth of both Marsupials and Placentals, the second teeth were early suppressed, although in the Edentates, which also originally had specialised molars, there is a typical succession of seven teeth behind the canine. These discoveries prove that the whale teeth, like their paddles, have acquired a secondary adaptive resemblance to those of the Icthyosaurs. How did the single and simple teeth of the Edentates and Cetaceans develop? Clearly by retrogression. As Leche points out in the aquatic Carnivora, in which th first series are degenerating, the single-series condition (monophyodontism) advances step by step with retrogressive simplification of the tooth form (homodontism); thus in the true seals, the eared seals and the walruses, as the permanent teeth become simpler, the milk teeth become smaller. The Edentates, so widely separated genetically, parallel the seals in tending to suppress the first series of teeth and simplify the crowns of the second series at the same time. We might jump to the conclusion that this gives us an explanation of the homodont and apparently monophyodont condition of the toothed whales, especially as it has been supposed they sprang from aquatic carnivora, but in this Order matters were reversed, for the first series persisted and the second series were suppressed and persist as a rudimental row of tooth caps buried in the jaw.

Each dental series has an adaptive evolution of its own, in Erinaceus the first series has an ancient and the second a modern form; in Ericulus both series are alike; in the Bats the first series is homodont, the second is heterodont (Leche); in the Edentates the first series is ancient and heterodont, the second is modern and homodont (Thomas, Rheinhardt), so among the Cetacea and Ungulata.

What deep and ancient clefts the different laws of succession mark between the Marsupials and these three Placental groups!

Primitive Heterodontism and Formula.

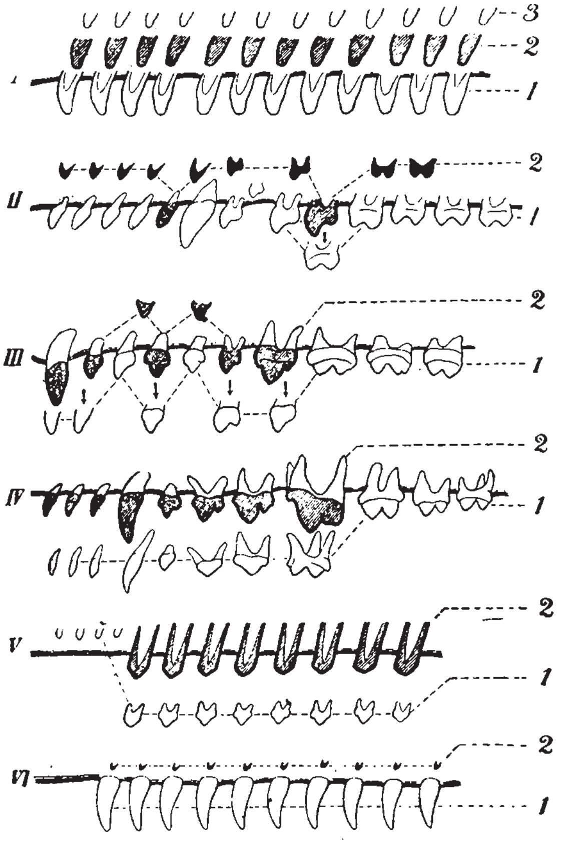
Now that all mammals are led back to a distant diphyodont stem, it is also true that the further we go back both in palingenesis and embryogenesis, the more widespread heterodontism is—all modern homodontism proving to be secondary. The simple conic teeth of the porpoise, for example, bear a misleading resemblance to those of a reptile. Flower, Weber, Julin, and Kükenthal agree that the ancestral whales and edentates were heterodont and had a smaller number of teeth than the existing forms.

Heterodontism is the second problem. Did the differentiation of the teeth into incisors, premolars, and molars occur before or after the Monotremes, Marsupials, and Placentals separated? It is well settled that the canine was the first maxillary tooth, and developed from the most anterior bi-fanged premolar; also, from the discovery of complete succession, we must now define the first molar as the most anterior specialised or triconid tooth, not as the most anterior permanent tooth. It seems to me we now find strong evidence that the stem mammals had a uniform number of each kind of teeth; in other words, a uniform dental formula. The Monotremes are most doubtful as the existing forms point only to primitive heterodontism. It will be a great step forward when we learn whether or not the Multituberculates are Monotremes—the resemblance of their molars to those of the duckbill is very superficial, for the duckbill upper molars lack the intermediate row of tubercles universally seen in the Multituberculates, and look to me rather like degenerate Tritubercular teeth. Cope has recently found in the cretaceous rocks a remarkable Tritubercular, which he names *Thlæodon;* the jaw of this animal is neither Placental nor Marsupial; it is like that of the Multituberculates—and both resemble remotely the degenerate modern Monotreme jaw. All we can say, therefore, is that the Multituberculates are an archaic group, highly specialised even in the Trias, that they were *probably* Monotremes, and neither structurally nor functionally akin to the Diprotodont Marsupials (Owen), nor to the Microbiotheridæ (Ameghino). With a dental mechanism and a condyle exactly like that of the rodents, they show no trace of canines, and the mode of evolution of their peculiar molars was probably paralleled later in the rodents. They present vestiges of a primitive dental formula like this: $I3$. C?. $P4$. $M4+$. *Thlæodon* shows $C1$. $P4$. $M3$. Thus, so far as this doubtful palæontological evidence goes, the Monotremes had a typical formula.

Our next step is to unify the typical 5. 1. 3. 4 of recent Marsupials with the 3. 1. 4. 3 of higher Placentals. Thomas has shown in his studies of recent Marsupials that they have probably lost one of the four typical premolars (*pm.* 2); this observation, fortunately, is partly confirmed by Röse's finding an embryonic germ of this tooth. Ignoring the incisors of the Jurassic Marsupials, Thomas raised the number of ancestral incisors to five, the highest number known among recent Marsupials; Röse therefore made another step towards uniformity when he showed that the Marsupial *i*.5 is probably a member of the second series of incisors, and should not be reckoned with the first. Now, if we suppose that the Placentals have lost one incisor, and one molar, abundant evidence of which is found in Otocyon, Centetes and Homo, we derive as the ancestral formula of both orders: $I4$. C & $P5$. $M4$.

The aberrant placental Cetacea point in the same direction, as we read in the conclusion of Weber's fine memoir: "All the

Cetacea sprang from a stem with a heterodont, but only partly specialised dentition (something like that of Zeuglodon, *I3. C1. P & M*). . . . not direct from Carnivores or Ungulates, but from a generalised mammalian type of the Mesozoic period, with some affinities with the Carnivora. . . . Zeuglodon itself branched off extremely early from the primitive line, and the heterodont Squalodon" (mark its formula, 3. 1. 4. 7.) "branched off later from the toothed whale line, after the teeth had begun to increase in number and before homodontism had set in." It would be easier for us while speculating to take Squalodon and the Odontocetes directly from the Jurassic mammalian formula (3. 1. 4. 8.). As for the multiplication of this formula, we have found the way, says Kükenthal, by which numerous homodont teeth have arisen from a few heterodont molars, namely, *by the splitting up of each of the molars of the Jurassic ancestors into three.* He substitutes this hypothesis for the one advocated by Baume, Julin, Weber, and Winge, that the multiple cetacean teeth represent the intercalation or joint appearance of both the first and second series of teeth, owing to the elongation of the jaw—a view which is now disproved by Kükenthal's discovery of the second row beneath the first. Since even by Kükenthal's hypothesis the typical Mesozoic mammals could not furnish as many teeth as are found in some of the dolphins, a likelier explanation than his seems to be that as the jaws were elongated the dental fold was carried back and the dental caps multiplied.



Relations of the First and Second Series of Teeth,

I. Reptiles. *II.* Marsupials. *III.* Insectivores (*Erinaceus*)
IV. Higher Placentals. *V.* Edentates. *VI.* Cetacea, Odontocetes

The Edentates, like the Cetaceans, point back to diphyodontism, and somewhat less clearly to a typical dental formula. We are here indebted to Flower, Rheinhardt, Thomas, Kükenthal, and Röse. It is their rudimental and useless first series which gives the evidence of heterodontism, while the second series has become adaptively rootless and homodont. The especially aberrant feature is that a double succession exists in the typical "true molar" region. The adult nine-banded Armadillo presents only eight maxillary teeth, seven of which are preceded by two-rooted milk teeth (Tomes); in the embryo Leche finds fifteen dental caps, of which only thirteen are calcified; this number probably includes the four rudimentary incisors observed by Rheinhardt. In the aberrant Orycteropus (Aard-Vark), with ten adult teeth, Thomas finds seven milk teeth behind the maxillary suture (thus taking us into the molar region of the typical heterodonts). The last of these milk teeth is large, and two-rooted; behind this are three large permanent posterior teeth, apparently belonging to the first series. The large lateral tooth of Bradypus is suggestive of a canine. From this rapidly accumulating evidence it appears probable that the ancestral Edentates had four incisors, a canine and eight or more teeth behind it, the double succession extending well back, so that the first series did not become permanent at the fifth tooth behind the canine, as in the Marsupials and higher Placentals. If these are primitive conditions, as seems probable from comparison with fossil Edentates, they carry the divergence of the Edentates, like that of the Cetaceans, back into the Mesozoic period. Comparative anatomy and embryology thus point back to highly varied branches of a generalised placental heterodont stem in the Mesozoic, and a much earlier divergence than we formerly imagined. Now let us see to what the early Mesozoic mammals point.

There are three distinct and contemporary Jurassic types, the Multituberculates, the Triconodonts, and the Trituberculates. Are not these the representatives of the Prototheria, Metatheria, and Eutheria? In the archaic Multituberculates we have seen a monotreme type of jaw and vestiges of a typical ancestral formula. The Triconodonts are a newer group, perhaps derived from the Domotheriidæ (incipient Triconodonts) of the Trias, although these appear to be aberrant; the typical forms extend from Amphilestes to Triconodon, and exhibit the first stages of development of the inflected Marsupial jaw. The Trituberculates include the Amphitheriidæ and Amblotheriidæ with true tuberculo-sectorial lower molars, like those of modern Insectivores; they alone exhibit the typical angular placental jaw—no reason can be assigned for calling them Marsupials, excepting the traditional reverence for the Marsupial stem theory. Now, it is very significant that the average dentition of these old but highly diverse forms, namely, Multituberculates, 3.?4. 6., Triconodonts, 4. 1. 4. 7., Trituberculates, 4. 1. 4-5. 8., is also the dentition to which the existing mammals apparently revert.

The third problem is from what type of molar tooth did the mammalian molar diverge?

(*To be continued.*)

SCIENTIFIC SERIALS.

Symons's Monthly Meteorological Magazine, December 1893.—In an article entitled "March to October, 1893," Mr. Symons deals with the temperature of the last eleven years in the north-west of London, with instruments identical in themselves and in exposure, with especial reference to the exceptional summer of the year 1893. The first two tables give the average monthly maximum in the shade, and the average maximum in the sun for 1883–92, compared with the mean values for 1893. In both cases the means of 1893 exceeded the average in each month, the excess of the shade maximum ranging from 1°·2 in September to 9°·7 in April, while the sun maximum shows an average excess of 7°·1, ranging from 1°·8 in July to 10°·8 in May. The tables showing the extreme maxima in shade and sun for each month of 1893, with the average of the highest reading in the ten corresponding months, again have plus signs in every instance in 1893, the greatest excess of the former being 10°·5 in April, while the mean of the eight months (March to October) shows an excess of 6°. The severe test of comparing the highest reading for each month of 1893 with the absolute highest reading in the corresponding month during the preceding ten years, shows that the season as a whole was unprecedented. The shade maxima were unequalled in April, June, July and August, the excess in April amounting to 5°·4, whereas in no other year of the ten have unequalled shade maxima occurred in more than two months. In some particulars August 1893 is unparalleled in thirty-six years. The shade temperature at 9h. a.m. on the 18th, viz. 84°·3, was 3°·5 higher than any other 9h. a.m. reading, and the shade maximum on the 16th to 19th all exceeded 90°, the only instance of this temperature being reached on three consecutive days.